Are patterns of night-time water use related to leaf nitrogen concentration in shoots of deciduous tree species?

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Several studies have been shown that nitrogen is the main mineral nutrient in plant tissues and the availability of nitrogen in the soil is frequently the main limitation for plant growth. The aim of our experiment was to test whether cut-shoots of 16 deciduous tree species show any patterns of species-specific water relations during night and day, and are there any influence of leaf nitrogen concentration (N_L) on circadian water relations. The all shoots from various habitats demonstrated substantial loss of water at night and the highest values of night-time water use percentage from daytime water use (NWU) was characteristic to species (Betula pubescens, Ulmus minor, Populus balsamifera) with low N_L (P < 0.05). However, the daytime transpiration rate (E_d; mmol m⁻² s⁻¹) exhibited positive relationship with N_L (P < 0.05). At the same time the increase in shoot night-time transpiration rate (INT) during predawn was also positively related to N_L across all studied species (P < 0.01). The species with low NWU demonstrated higher INT during predawn (P < 0.05). Our results suggest that studied species had different patterns of night-time water use and this experiment provides new insight into patterns of night-time water relations in context of nitrogen use and acquisition.

Keywords: Growth chamber, night-time water relations, nitrogen, predawn stomatal opening.